Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).
The present invention relates to a can end for a can, such as an easy opening can, and to such a can provided with at least one such a can end.

Such cans are intended for use as a beverage can and as a food can. Generally, beverage cans are thin walled (0.04 - 0.15 mm). Such a beverage can obtains its strength (after filling and closure) by an internally built up pressure. To that extent the can is filled and provided with gas generating material. After closure, gas formation results in the internal build up of pressure.

Generally, food cans are provided with food which may have to be subjected to a pasteurization or sterilization procedure. Accordingly, pressure build up may be temporary during such procedure. However, due to undesired circumstances bacterial growth might result in internal pressure build up after the food can was filled and closed.

In relation to both food cans and beverage cans improper processing filling and handling of such cans may result in temporary or continuous pressure build up which may result in a deformation of in particular the can closure at the top end and/or the bottom end. Accordingly, overfilling the can with the content material, too high processing temperatures, unsatisfactory cooling operations, insufficient vacuum drawing in the can, pre-process spoilage of content, gas formation due to an undesired reaction between can metal and the content resulting in gas formation such as hydrogen gas, and incorrect handling resulting in impacting on the can may result in continuous or temporary pressure build up. These pressure build ups may result in a deformation of the can ends to an extent dependent on the pressure build up.

One form of localized distortion of the can end is buckling or pleating resulting in a local distortion which could extent into the counter sink and seaming region. The bulked portion may even locally extent beyond the perimeter of the can. Higher pressure build up may result in bulging or even the formation of a so called springer. Such bulges may be forced back into the normal can end position. A hard blow will result in a severe and permanent outbulging of one or both ends of the can.

In this respect it is noted that can ends may be designed such that due to pressure build up the concave can end flips out into a convex form (see for instance EP 0 906 222).

US 2005/0029269 relates to can shell and to a double-seamed can end. The can end has a convex central panel connect via a panel wall, a counter sink, and a structured transitional to a seaming curl. The countersink internal curvature is determined by two radii and is generally wider than the two radii.

The present invention has for its object to provide a can end for a can, such as an easy opening can, which sustains higher internal pressures than a conventional can end while managing volume expansion. The can end of the invention has a form such that the resistance of the can end to distortion due to pressure build up is improved. For instance, a can provided with a can end according to the invention having a diameter ranging from 45 - 260 mm may resist pressures built up to more than 2 bar preferably up to more than 3 - 4 bar or even up to more than 5 bar. But, if a pre-designed pressure build up is surpassed, then the can end will distort but such that its form will not transform from a concave form into a convex form but will be provided with irregular distortions. Accordingly, the consumer could appreciate that due to the irregular buckled or pleated can end the content may be spoilt and should not be consumed.

The form and shape of the can end according to the invention is having a form and shape designed such that high pressure resistance and/or expansion is obtained preferably at minimum thickness of closure and/or body of the can. The pressure resistance is such that the can end and/or can may undergo a temporary deformation due to the pressure built up. Such a deformation allows temporary increase of internal volume of the can thus minimizing the actual pressure. It also allows inspection of the cans according to the invention at different stages during filling, closing, processing and storing using classical detector systems monitoring the outer shape properties. Accordingly, the opportunity is provided to inspect the cans for too low or too high internal pressure. This will provide relevant information in relation to the closing of the cans in pressurization processes and could detect undesired pressure loss due to leakages or pressure increases due to spoilage.

The present invention is the result of insights based on experimental research so that by particular shaping and dimensioning the can end the above objectives are fulfilled and the above mentioned drawbacks substantially overcome.

Accordingly, the present invention provides a can end for a can, such as an easy opening can, as claimed by claim 1.

The panel wall angle $A_2$, $P_2$ is selected within the range of 2° - 45°. At a lower angle connecting, such that seaming the can end onto the body may be difficult or problematic. An angle beyond 45° will have an adverse effect on the pressure performance.

The panel radius $R_4$ is preferably selected within the range of 1.0 - 1.5 mm. A panel radius $R_4$ larger than 2 mm may result in a reduction of strength and thereby the occurrence of pleating and buckling in the region towards the counter sink.
The counter sink radius $R_3$ should be less than 5 mm. Otherwise, the strength would be insufficient. A counter sink radius $R_3$ lower than 0.5 mm could result in lacquer cracking during the forming of the metal.

For a can bottom intended as a can bottom the optimum panel depth $H_2$ is between 2 - 5 mm and for a top closure is $H_2$ optimal 2.0 - 2.5 mm.

The counter sink radius $R_3$ should be less than 5 mm. Otherwise, the strength would be insufficient. A counter sink radius $R_3$ lower than 0.5 mm could result in lacquer cracking during the forming of the metal.

Smaller pleats and less buckles are formed when the panel radius $R_4$ is selected in the preferred range of 1.0 - 1.5 mm, or even at 1.25 - 1.5 mm.

Optimally, the panel depth $H_2$ is selected between 2.0 - 2.5 mm.

It is noted that the foot of the can bottom may have an outer foot radius $R_{14}$. The dimensions of the outer foot radius $R_{14}$ depends on the distance between the foot radius $R_{13}$ and the end foot radius $R_2$.

It is preferred that the can end is provided with a panel outer ring. Such panel outer ring will decrease the sensitivity to pleat formation.

For a can bottom it is preferred that in the can bottom a panel outer ring slope ($A_3$) is 0° - 35° and a panel outer ring width ($L_1$) is 0 - 15 mm. The panel outer ring slope $A_3$ may be up to 35°. A minimum $A_3$ is about 1°. Preferably the panel outer ring slope $A_3$ ranges from 2° - 20°. The panel outer ring width $L_1$ is up to 15 mm. A minimum panel outer ring width for improved properties starts from about 0.5 mm or from 1 mm. Preferably $L_1$ is within the range of 1 - 5 mm.

According to another general embodiment according to the present invention the can end according to the invention has the unit depth ($H_4$) is 2 - 10 mm, preferably is 5 - 7 mm. It is preferred that the can end is provided with a panel outer ring. Such panel outer ring will decrease the sensitivity to pleat formation.

For optimal properties the can lid according to the invention has the unit depth ($H_4$) is 5 - 7 mm.

When the can lid is provided with a panel outer ring then it is preferred that in the can lid the panel outer ring slope ($P_3$) is 0° - 35° and the panel outer ring width ($L_1$) is 0 - 15 mm, preferably 1 - 3 mm, more preferably 1 - 2 mm. The panel outer ring width $L_1$ for the can lid is less than 15 mm and a minimum width is about 0.5 mm. A preferred range for the outer ring width $L_1$ for the can lid is 1 - 3 mm, more preferably 1 - 2 mm.

The panel outer ring slope $P_3$ of the can lid according to the invention is preferably up to 35°. A minimum slope $P_3$ is as from 0.5° more preferably as from 1° or 2°. The general range is therefore from 0.5° - 35° preferably 2° - 20°.

In both can lid and can bottom there may be an angle with the transition wall. This foot wall angle $A_1$ ranges from 0° - 45°, preferably from 2° - 35°.

When present the panel outer ring $L_1$ has a width of more than about 0.1 to 0.2 mm. When present the panel outer ring may be provided with the score line. Preferably, the score line is located closer to the panel center than to the
counter sink which is optimal for the burst resistance.

Preferably, the panel ring has a slope $A_3$, $P_3$ such that higher internal pressures will less distort the form and structure of the can end. The panel ring slope $A_3$, $P_3$ may be up to 35° which results in a reduction of the formation of pleats. Preferably, then panel ring slope $A_3$, $P_3$ is within the range of 2° - 20° whereby the panel is provided with a well rounded shape which is least distorted due to internal pressure build up.

The can end according to the invention may be an easy opening can end for an easy opening can. Thus, for opening the can via a preformed opening defined by a score line in the can end it is preferred that the can end is provided with an opening tab.

According to another aspect of the invention is provided a can which comprises a body and at least one can end according to the invention as described above. In one embodiment of the can according to the invention, the body may be provided at both ends with a can end according to the invention. In another embodiment only the can lid is a can end according to the invention. The can bottom or can lid may be integral with the body of the can and formed by any conventional process such as DWI, DRD and (deep) drawing. In another embodiment the can may be provided with a body and a can lid and with a can bottom which is a can end according to the invention.

Another preferred can according to the invention is a can which is composed of a can lid as described above (preferably with an opening tab and cooperating score line) and with another can lid as described above (not provided with opening means) but functioning as a can bottom. Accordingly, the advantage is obtained that the can lid functioning as a can bottom due to its design has a larger radius and therefore better in internal pressure resistance and allowing more expansion within elastic limits. According to another embodiment the can is provided with a can lid and with a can bottom as described above in relation to the present invention. Either of the can ends may be integral with the body of the can. The other can end is connected to the body of the can by traditional techniques such as seaming.

Mentioned and other features and characteristics of the can end and can according to the present invention will be further illustrated by means of several embodiments which are given for illustrative purposes and are not intended to limit the present invention to any extend. In particular, cans are illustrated with an easy open end, but of course, such cans could also be realized with one or more sanitary end or more generally a non-easy open end. These embodiments will be further illustrated by means of several embodiments which are given for illustrative purposes and are not intended to limit the present invention to any extend. In particular, cans are illustrated with an easy open end, but of course, such cans could also be realized with one or more sanitary end or more generally a non-easy open end. These embodiments will be further illustrated by means of several embodiments which are given for illustrative purposes and are not intended to limit the present invention to any extend.

Figure 1 shows a can lid or can bottom 1 according to the invention. The can end has a central panel 2 and a counter sink which is optimal for the burst resistance.

In comparison to the can end 1 of figure 1 is the panel wall angle $P_2$ increased. The panel radius $R_4$ is also increased as well as the counter sink radius $R_3$. The panel depth is also reduced.

In the can end 1 is the panel wall angle $P_2$ 15°, the panel radius $R_4$ 1.30 mm, the panel depth $H_2$ 2.3 mm and the counter sink radius $R_3$ 0.6 mm.

Figure 2 shows another can end 10 according to the invention.

[0040] Figure 1 shows a can lid or can bottom 1 according to the invention. The can end has a central panel 2 and a can end radius or curl 3 for attachment, for instance by seaming, to a body of a can. The can end 1 further comprises a counter sink 4 which is connected via a transition wall 5 to a seaming panel 6 of the curl 3. The counter sink 4 is also connected via a panel wall 7 to the panel 2.

The panel wall angle $P_2$ is determined by the slope 8 of the panel wall 7 relative to the vertical line 9. The panel radius $R_4$ determines the curvature of the connection between the panel wall 7 and the panel 2. The counter sink radius $R_3$ determines the internal curvature of the section between the panel wall 7 and the chuck wall 5. Finally, the panel depth $H_2$ is the distance between the underside of the counter sink and the panel 2 and unit depth $H_1$ the distance between seaming panel 6 and the counter sink underside.

In the can end 1 is the panel wall angle $P_2$ 15°, the panel radius $R_4$ 1.30 mm, the panel depth $H_2$ 2.3 mm and the counter sink radius $R_3$ 0.6 mm.

[0043] Figure 2 shows another can end 10 according to the invention.
As shown in figure 2 is the can end 10 further provided with a panel outer ring 11 at the circumference of the panel 2 and connected via the panel wall 7 to the counter sink 4. The outer ring 11 has a width L₁ of 1 mm and is provided with a score line 12. The panel outer ring 11 has a slope with the horizontal 13. This panel outer ring slope P₃ is 20°.

The dimensions of the can end 10 are panel wall angle P₂ = 30°, panel radius R₄ = 0.8 mm, panel depth H₂ = 1.2 mm, counter sink radius R₃ 0.9 mm and panel outer ring width L₁ 1.5 mm.

Figure 3 shows a can end 14 according to the invention. In comparison to the can end 10 illustrated in figure 2, the panel wall angle P₂ is 10°, the panel radius R₄ is 1.8 mm, the panel depth H₂ is 2.4 mm and the counter sink radius R₃ is 0.6 mm. Furthermore, the outer ring width L₁ is 1.5 mm and the outer ring panel slope P₃ is 10°.

The following table shows buckle resistance of the can ends 1, 10 and 14 (made of steel) dependent on metal range and metal temper.

<table>
<thead>
<tr>
<th>Case Identification</th>
<th>Metal Gauge</th>
<th>Metal Temper</th>
<th>Burst Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Closure 1 of figure 1</td>
<td>0.23 mm</td>
<td>TH 580</td>
<td>4.9 bar</td>
</tr>
<tr>
<td>Closure 10 of figure 2</td>
<td>0.23 mm</td>
<td>TH 580</td>
<td>4.0 bar</td>
</tr>
<tr>
<td>Closure 14 of figure 3</td>
<td>0.23 mm</td>
<td>TH 580</td>
<td>5.1 bar</td>
</tr>
</tbody>
</table>

The minimal value of the outer radius R₁₄ is dependent on the distance between the food radius R₁₃ and the end food radius R₃.

The following table shows the buckle (pressure) resistance of the can end 24 of figures 6-8 at a wall thickness of 0.22 mm and dependent on the unit depth H₁ and the panel depth H₂.

<table>
<thead>
<tr>
<th>Thickness</th>
<th>H₁ (mm)</th>
<th>H₂ (mm)</th>
<th>Buckle Pressure (bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.22</td>
<td>5.6</td>
<td>3</td>
<td>52</td>
</tr>
<tr>
<td>0.22</td>
<td>6</td>
<td>3</td>
<td>53</td>
</tr>
<tr>
<td>0.22</td>
<td>6.4</td>
<td>3</td>
<td>54</td>
</tr>
<tr>
<td>0.22</td>
<td>6.8</td>
<td>3</td>
<td>55</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Thickness</th>
<th>H₁ (mm)</th>
<th>H₂ (mm)</th>
<th>Buckle Pressure (bar)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.22</td>
<td>6</td>
<td>2.6</td>
<td>52</td>
</tr>
<tr>
<td>0.22</td>
<td>6</td>
<td>2.8</td>
<td>52</td>
</tr>
<tr>
<td>0.22</td>
<td>6</td>
<td>3</td>
<td>53</td>
</tr>
<tr>
<td>0.22</td>
<td>6</td>
<td>3.2</td>
<td>54</td>
</tr>
</tbody>
</table>
Figure 9 shows an alternative can bottom 33 according to the invention. This can bottom 33 comprises a panel 34 which is directly connected to a panel radius 35. Accordingly, this panel 34 does not comprise a panel ring.

Figure 10 shows still another embodiment of a can bottom 36 according to the invention. In this embodiment the can end/foot radius 31 is directly connected to the body wall 32 of the can. Accordingly, this can bottom 36 does not comprise the foot radius R13 and the outer foot radius R14 (see figure 7).

Figure 11 shows still another embodiment in the form of a can bottom 37 in comparison to the can bottom 24 of figure 8, the can bottom 37 comprises in the body wall 32 a rolling bead 38 for guiding the closed can provided with the can bottom 37 during processing in a continues cooker.

Figure 12 shows another embodiment of a can bottom 39 of the invention. This can bottom 39 comprises a body wall 32 and a can end/foot radius 31 connected via a transition or chuck wall 30 and a counter sink radius 29 to a panel wall 28. The panel wall 28 is connected via a panel radius 27 to a central panel 40. In comparison to the can bottom 24 of figure 6 this panel has a convex shape as the integral can bottom 17 (not according to the invention) as illustrated for the can 15 of figure 4.

Figure 13 shows a can 41 comprising a body wall 42 provided with a can lid 43 and an integral can bottom 44. The can lid 43 is a can lid 14 as shown in figure 3. The can lid 14 is connected by a seam 45 to the body wall 42. The can lid 14 is provided with an opening tab 46 for opening the can 41 via an opening determined by a score line 12 formed in panel outer ring 11. The can bottom 44 is a can end 1 as presented in figure 1 as a can lid but integrally formed with the body wall 42. The can end 1 comprises the panel 2 connected via the panel wall 7 and the counter sink 4 and the transition wall 5 to the curl or can end radius 3 which integrally is connected to the body wall 42.

Figure 14 shows another can 47 according to the invention. It is an alternative to the can 15 shown in figure 4. In this alternative the can bottom 48 is formed by the can bottom 24 as shown in figure 6.

Figure 15 shows another can 49 according to the invention which is an alternative to the can 44 of figure 13. In this case the can bottom 50 has the form of the can bottom 39 as illustrated in figure 12.

Finally, figure 16 shows a can 51 according to the invention in which a can lid 54 and a can bottom 52 are both seamed to a can body 53.

It is noted that the various can lids and can bottoms could be manufactured by standard technologies by drawing from a disc shape metal part using various dies for forming the various can end structures. Each can end may be used as can lid and/or can bottom as is desired.

The metal used may be of any suitable metal such as aluminum, steel, plated steel. The metal may be provided with a coating in the form of a lacquer or plastic layer as is traditionally used for food and beverage cans.

Claims

1. Metallic can end for a can, such as an easy opening can, comprising

   - a flat or concave central panel (2),
   - a can end radius for connection to a body of the can; and
   - a countersink connected via a transition wall to the can end radius and via a straight panel wall (4) to the central panel (2), wherein
     - a panel wall angle (A2, P2) is 2° - 45°,
     - a panel radius (R4) is larger than 0.5 mm
     - a panel depth (H2) is 1 mm - 7 mm, and
     - a single counter sink radius (R3) in the range of 0.5mm to 5 mm, wherein the countersink radius determines the internal curvature of the section between the panel wall (7) and the transition wall.

2. Can end as claimed in claim 1, wherein the panel wall angle (A2, P2) is 5° - 35°, and/or the panel radius (R4) is 1.0 - 1.5 mm.

3. Can end as claimed in claim 1 or 2, wherein the can end is a can bottom, and the can end radius forms a foot and the foot has an end foot radius R2 which is less than 5 mm, preferably 0.5 - 1.5 mm.

4. Can end as claimed in claim 3, wherein the counter sink radius (R3) is 0.5 - 1.5 mm, and/or the panel depth (H2) is 2 - 5 mm.

5. Can end as claimed in claim 3 or 4, wherein a foot radius (R13) is less than 5 mm, preferably 0.5 - 1.5 mm.

6. Can end as claimed in claims 3-5, wherein the foot height (H11) is 1 - 7 mm, preferably 2 - 5 mm.
7. Can end as claimed in claims 3-6, wherein the unit depth (H₁) is 2 - 10 mm, preferably 5 - 7 mm.

8. Can end as claimed in claims 3-7, wherein a panel outer ring slope (A₃) is 0° - 35° and a panel outer ring width (L₁) is 0 - 15 mm, and preferably the panel outer ring slope (A₃) is 2° - 20°, and/or the panel outer ring width (L₁) is 1 - 5 mm.

9. Can end as claimed in claim 1 or 2, wherein the can end is a can lid, and preferably the panel depth (H₂) is 2.0 - 2.5 mm, and/or the counter sink radius (R₃) is 0.5 - 0.7 mm.

10. Can end as claimed in claim 9, wherein the unit depth (H₁) is 5 - 7 mm.

11. Can end as claimed in claim 9 or 10, wherein the panel outer ring slope (P₃) is 0° - 35° and the panel outer ring width (L₁) is 0 - 15 mm, preferably 1 - 3 mm, more preferably 1 - 2 mm, and preferably the panel outer ring slope (P₃) is 2° - 20°.

12. Can comprising a body and at least one can end according to claims 1-11, and preferably the at least one can end is a can lid according to claims 9-11 or a can bottom according to claims 3-8.

13. Can as claimed in claim 12, wherein the can comprises a can lid and as a can bottom another can lid.

14. Can as claimed in claim 12, wherein the can comprises a can lid and a can bottom.

15. Can according to claims 12-14, wherein the can lid or can bottom is integral with the body of the can.

**Patentansprüche**

1. Metallisches Dosenende für eine Dose wie eine leicht zu öffnende Dose, enthaltend
   - ein flaches oder konkaves zentrales Feld (2),
   - einen Dosenendradius zur Verbindung mit einem Körper der Dose; und
   - eine Versenkung, die über eine Übergangswand mit dem Dosenendradius und über eine aufrechte Feldwand (4) mit dem zentralen Feld (2) verbunden ist, wobei
   - ein Feldwandwinkel (A₂,P₂) 2° bis 45° beträgt,
   - ein Feldradius (R₄) größer ist als 0,5 mm
   - eine Feldtiefe (H₂) 1 mm bis 7 mm beträgt, und
   - ein einziger Versenkungsradius (R₃) in dem Bereich von 0,5 mm bis 5 mm liegt, wobei der Versenkungsradius die innere Krümmung des Abschnitts zwischen der Feldwand (7) und der Übergangswand bestimmt.

2. Dosenende nach Anspruch 1, wobei der Feldwandwinkel (A₂,P₂) 5° bis 35° beträgt und/oder der Feldradius (R₄) 1,0 - 1,5 mm beträgt.

3. Dosenende nach Anspruch 1 oder 2, wobei das Dosenende ein Dosenboden ist und der Dosenendradius einen Fuß bildet und der Fuß einen Endfußradius R₂ hat, der kleiner als 5 mm ist, vorzugsweise 0,5 bis 1,5 mm.

4. Dosenende nach Anspruch 3, wobei der Versenkungsradius (R₃) 0,5 bis 1,5 mm beträgt und/oder die Feldtiefe (H₂) 2 bis 5 mm beträgt.

5. Dosenende nach Anspruch 3 oder 4, wobei ein Fußradius (R₃₁₃) kleiner als 5 mm ist, vorzugsweise 0,5 bis 1,5 mm.

6. Dosenende nach den Ansprüchen 3 bis 5, wobei die Fußhöhe (H₁₁) 1 bis 7 mm, vorzugsweise 2 bis 5 mm beträgt.

7. Dosenende nach den Ansprüchen 3 bis 6, wobei die Einheittiefe (H₁) 2 bis 10 mm, vorzugsweise 5 bis 7 mm beträgt.

8. Dosenende nach den Ansprüchen 3 bis 7,
wobei eine äußere Feldringneigung (A_3) 0° bis 35° beträgt und eine äußere Feldringbreite (L_1) 0 bis 15 mm ist und vorzugsweise die äußere Feldringneigung (A_3) 2° bis 20° beträgt und/oder die äußere Feldringbreite (L_1) 1 bis 5 mm ist.

9. Dosenende nach Anspruch 1 oder 2, wobei das Dosenende ein Dosendeckel ist und vorzugsweise die Feldtiefe (H_2) 2,0 bis 2,5 mm und/oder der Versenkungsradius (R_3) 0,5 bis 0,7 mm beträgt.

10. Dosenende nach Anspruch 9, wobei die Einheitstiefe (H_1) 5 bis 7 mm beträgt.

11. Dosenende nach Anspruch 9 oder 10, wobei die äußere Feldringneigung (P_3) 0° bis 35° beträgt und die äußere Feldringbreite (L_1) 0 bis 15 mm, vorzugsweise 1 bis 3 mm, noch bevorzugter 1 bis 2 mm beträgt und vorzugsweise die äußere Feldringneigung (P_3) 2° bis 20° beträgt.

12. Dose mit einem Körper und wenigstens einem Dosenende nach den Ansprüchen 1 bis 11, wobei vorzugsweise das wenigstens eine Dosenende ein Dosendeckel nach den Ansprüchen 9 bis 11 oder ein Dosenboden nach den Ansprüchen 3 bis 8 ist.

13. Dose nach Anspruch 12, wobei die Dose einen Dosendeckel und als einen Dosenboden einen weiteren Dosendeckel hat.

14. Dose nach Anspruch 12, wobei die Dose einen Dosendeckel und einen Dosenboden hat.

15. Dose nach den Ansprüchen 12 bis 14, wobei der Dosendeckel oder der Dosenboden integral mit dem Körper der Dose ist.

**Revendications**

1. Extrémité de boîte métallique destinée à une boîte, telle qu’une boîte à ouverture facile, comprenant :

   - un panneau central (2) plat ou concave,
   - un rayon d’extrémité de boîte destiné à être relié à un corps de la boîte ; et
   - une partie en retrait reliée, par l’intermédiaire d’une paroi de transition, au rayon d’extrémité de boîte et, par l’intermédiaire d’une paroi de panneau droite (4), au panneau central (2), dans laquelle
   - un angle de paroi de panneau (A_2, P_2) est de 2° à 45°,
   - un rayon de panneau (R_4) est supérieur à 0,5 mm,
   - une profondeur de panneau (H_2) est de 1 mm à 7 mm, et
   - un rayon de partie en retrait unique (R_3) dans la plage de 0,5 mm à 5 mm, dans laquelle le rayon de partie en retrait détermine la courbure interne de la section entre la paroi de panneau (7) et la paroi de transition.

2. Extrémité de boîte selon la revendication 1, dans laquelle l’angle de paroi de panneau (A_2, P_2) est de 5° à 35° et/ou le rayon de panneau (R_4) est de 1,0 à 1,5 mm.

3. Extrémité de boîte selon la revendication 1 ou 2, dans laquelle l’extrémité de boîte est un fond de boîte, et le rayon d’extrémité de boîte forme un pied et le pied a un rayon de pied d’extrémité (R_2) qui est inférieur à 5 mm, de préférence de 0,5 à 1,5 mm.

4. Extrémité de boîte selon la revendication 3, dans laquelle le rayon de partie en retrait (R_3) est de 0,5 à 1,5 mm, et/ou la profondeur de panneau (H_2) est de 2 à 5 mm.

5. Extrémité de boîte selon la revendication 3 ou 4, dans laquelle un rayon de pied (R_13) est inférieur à 5 mm, de préférence de 0,5 à 1,5 mm.

6. Extrémité de boîte selon les revendications 3 à 5, dans laquelle la hauteur de pied (H_11) est de 1 à 7 mm, de préférence de 2 à 5 mm.
7. Extrémité de boîte selon les revendications 3 à 6, dans laquelle la profondeur de l’unité (H₁) est de 2 à 10 mm, de préférence de 5 à 7 mm.

8. Extrémité de boîte selon les revendications 3 à 7, dans laquelle une pente d’anneau externe de panneau (A₃) est de 0° à 35° et une largeur d’anneau externe de panneau (L₁) est de 0 à 15 mm, et de préférence la pente d’anneau externe de panneau (A₃) est de 2° à 20°, et/ou la largeur d’anneau externe de panneau (L₁) est de 1 à 5 mm.

9. Extrémité de boîte selon la revendication 1 ou 2, dans laquelle l’extrémité de boîte est un couvercle de boîte, et de préférence la profondeur de panneau (H₂) est de 2,0 à 2,5 mm, et/ou le rayon de partie en retrait (R₃) est de 0,5 à 0,7 mm.

10. Extrémité de boîte selon la revendication 9, dans laquelle la profondeur de l’unité (H₁) est de 5 à 7 mm.

11. Extrémité de boîte selon la revendication 9 ou 10, dans laquelle la pente d’anneau externe de panneau (P₃) est de 0° à 35° et la largeur d’anneau externe de panneau (L₁) est de 0 à 15 mm, de préférence de 1 à 3 mm, plus préfériblement de 1 à 2 mm, et de préférence la pente d’anneau externe de panneau (P₃) est de 2° à 20°.

12. Boîte comprenant un corps et au moins une extrémité de boîte selon les revendications 1 à 11, et de préférence ladite au moins une extrémité de boîte étant un couvercle de boîte selon les revendications 9 à 11 ou un fond de boîte selon les revendications 3 à 8.

13. Boîte selon la revendication 12, dans laquelle la boîte comprend un couvercle de boîte et, en tant que fond de boîte, un autre couvercle de boîte.

14. Boîte selon la revendication 12, dans laquelle la boîte comprend un couvercle de boîte et un fond de boîte.

15. Boîte selon les revendications 12 à 14, dans laquelle le couvercle de boîte ou le fond de boîte est d’un seul tenant avec le corps de la boîte.
REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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